PUBLIC SERVICE COMMISSION OF WISCONSIN

Memorandum

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FOR COMMISSION INFORMATION

TO: The Commission

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RE: Universal Service, Data Transmission Speeds, and Broadband Availability.

The purpose of this memo is to provide background about data transmission speed and broadband issues. These topics relate to a rule-making docket (1-AC-198) on the state universal service fund (USF), which will soon be coming to the Commission for issuance of a notice. Whether, and how, to address the data transmission and broadband issues in that rulemaking are Questions that need to be clarified so that the rule making can proceed. This broadband issue is important: Governor Doyle emphasized this when he issued a challenge to his administration, the legislature, the private sector, and local governments "to provide universal access to competitively priced broadband for every business and home in Wisconsin in five years."[1] Without action, that ubiquity of broadband access is not likely to evolve.

Current Rules

The statutes require the Commission to undertake periodic review of the USF rules. A review of those rules (in Wis. Admin. Code ch. PSC 160) will be undertaken in docket 1-AC-198. Wis. Stat. § 196.218(4) requires the Commission to include in the USF rules a

[1] Governor Doyle, Grow Wisconsin Plan, September 10, 2003.

definition of “essential telecommunications services,” that is, the minimum set of services which all telecommunications providers are required to provide to all customers. The list of essential services required by statutes includes “line quality capable of … data transmission.” The statutes do not further define this “data transmission" quality, but leave that to the Commission.

The current standard for data transmission, established by Commission rules,[2] is a modem speed of 9.6 kilobits per second (kbps) on lines that do not exceed 10,000 feet in length. That standard was reasonable in 1995, when the rule was initially drafted; however, customers demand a much higher speed today. In 1995, email was limited to primitive, plain text messages, and other online services were primarily limited to sharing small files. That is no longer true. The minimum speed for modems sold today is 56 kbps, and commonly purchased alternatives are many times faster than those modems. More than half of all U.S. households have Internet access, and approximately one in four subscribes[3] to a broadband service.[4]

The Current Broadband Landscape

Customers have a number of options for obtaining broadband services.[5] These include DSL service, cable modems, and high-speed data lines like T-1s, although the cost and complexity of using T-1s restricts them to business applications. Other services, like Integrated Services Digital Network (ISDN) and satellite service, exist, but their costs and drawbacks have stifled demand for these services. A number of newer technologies (like fixed wireless,

[2] Wis. Admin. Code § PSC 160.031.
[3] *A Nation Online, Entering the Broadband Age*, National Telecommunications and Information Administration (NTIA), U.S. Dept. of Commerce, September 2004, executive summary and pp. 4-5.
[4] Broadband in this context means the ability to access the Internet at speeds much faster than dial-up services. The Rural Utility Service (RUS) defines broadband service as one capable of data transmission at a rate of at least 200 kbps in both directions. The Federal Communications Commission (FCC) speaks of high-speed services, which provide for a speed of 200 kbsp in one direction--getting that speed in the download direction often meets many customer needs.
[5] Additional detail on these services is provided in Appendix A.

broadband over power line, and Wi-Max) may, or may not, become major players in the broadband market. Only time will tell.

What is already clear is that deployment of broadband service is proceeding much more rapidly in urban areas, where the costs are lower and the number of potential customers significantly higher, than in rural areas.[6] According to the NTIA report (see Footnote 3), almost 1 in 4 rural customers list "not available" as the reason for not subscribing to a broadband-like service, compared to less than 1 in 20 citing that reason in urban areas.[7] According to Governor Doyle, when he introduced the Grow Wisconsin Plan: "Access to advanced telecommunications services is a critical tool for economic development in the 21st century. Wisconsin businesses and residents must have access to high speed, interactive telecommunications services if they are to compete in today's economy. While progress is being made to provide universal access in the state, we have far too many communities and far too many businesses that are falling behind."

In fall, 2004, the Commission staff conducted a survey of rural Wisconsin Chambers of Commerce (Chambers) asking about Internet usage.[8] Almost half of the Chambers surveyed reported that member businesses have had problems obtaining the data transmission services, or speeds, they require. These same respondents report that problems are worse in more rural areas, and for residential customers.

Barriers to Broadband Deployment Today

Telecommunications providers are in the middle of a transition from traditional, circuit switched, voice telephony to digital, packet-based services. Wisconsin telephone companies are also making this change, and are generally making the necessary investments and plant upgrades

[6] There are, of course, exceptions; some small telecommunications utilities for instance have been more proactive in deploying higher speed services than some larger providers.
[7] NTIA report, pp. 13-15.
[8] The survey and results are detailed in Appendix B.

to support this shift in serving architecture. In some cases, however, these investments are not being made. Three primary reasons are implicated as to why some companies have not invested in the infrastructure needed to deploy broadband services, in at least some areas or exchanges.

First, some companies have decided that their capital resources can more profitably be spent in other areas, generally in other states or countries. In the past, some companies have underinvested in Wisconsin properties, and later sold off them off. While it is not clear to what extent this activity is still happening in Wisconsin, the decline in intrastate investments[9] by some large providers indicates that it may continue to be a concern for the Commission--and customers.

Second, a few companies have been slow to accept the need to offer services beyond traditional voice telephony. Recent activities among the smaller telecommunications providers indicate that this problem is increasingly rare, but it may still exist in a few utility boardrooms. Further, the lack of deployment of advanced services in some of these areas may not indicate a failure to perceive the value of these advanced services, but may indicate that the services--in some markets--are just not profitable.

Thus, lack of profitability may be the third problem. For some areas, the distances which must be traversed to reach outlying customers and the low density of potential customers might mean that the services will never be able to contribute adequately to recover the investments necessary to deploy them, regardless of the technology used. It is not clear how widespread such areas might be, exactly where they are, or whether future technologies might allow them to be profitably served, but it is clear that some areas of the state are not served with high speed capabilities at present and that utilities frequently cite cost as a reason.

[9] Data on investment patterns, pulled from the annual report system, was provided to the Commissioner's Office (CO) via email on June 4, 2004.

Approaches to Stimulate Broadband Deployment

The first two reasons cited above for companies failing to invest in broadband services--deciding to invest available capital in markets outside Wisconsin or failure to realize the need to enter the broadband market, can be addressed by Commission rules. A rule requiring, directing, emphasizing, or providing significant incentives for broadband investment will make the providers at least consider broadband services. The more potent the rule, the more serious consideration it will engender.

A rule will not change the third problem slowing broadband investment--lack of profitability. However, a rules package may identify and quantify the areas, if any, where broadband services are actually not profitable, and quantify how unprofitable broadband would be in those areas. Once that data is available, the Commission could consider providing the targeted subsidies required to meet the Governor's goal of universal, affordable broadband service.

Broadband deployment is growing--nationally and at the state level. The issue to consider is whether to let the market approach play out (with the potential for some enclaves of less-than-adequate services), or to take steps to encourage more broadband deployment. Any plan or rule for stimulating broadband services needs to meet several criteria.

First, the plan should be technologically neutral, not favoring one technology over another. Providers should be free to choose the technology that best meets their business plans and needs even if that means that a provider is partnering with another provider or moving outside its traditional technologies. Providers should even be able to meet their requirements by reselling the services of other providers. The concern of a universal broadband plan should be that customers have access to broadband, not what type of technology is used to get it to

customers' homes and businesses. A reasonable caveat should be that any broadband product intended to meet a broadband goal must be usable and affordable by the average customer.

Second, the plan should be provider neutral. It should not apply only to one type of provider; for example, only to incumbent local exchange companies. It should apply to all providers subject to Commission jurisdiction, in the same way that the set of essential services defined in Wis. Admin Code § PSC 160.03 applies to all providers.[10] Alternatively, if the Commission desires to apply the rules only to some, and not all providers, the Commission could place the requirements only on providers designated as eligible telecommunications carriers (ETCs), since those companies have already agreed to assume additional universal service requirements in return for being eligible for universal service funds. If any eligible Telecommunications carrier (ETC) found the new requirements too burdensome, the provider could surrender ETC status in Wisconsin.

Third, any broadband availability plan should recognize that providers cannot instantaneously deploy the infrastructure necessary to offer broadband. A plan needs to include reasonable timelines and goals--but also to recognize that many providers have already deployed these services. The experiences of those providers that have deployed and marketed broadband services can serve as examples of what is possible and reasonable.

Alternative Commission Strategies on the Broadband Issue

The Commission can take one of four basic options to address this issue. Sample language for some of these approaches is presented in appendices to this memo.

First, the Commission could do nothing; it could leave the existing data transmission requirement of 9.6 kbps in place. This approach would leave to providers and market forces the

decision on when and where to deploy more high-speed capabilities. Such an approach would also seemingly ensure that the businesses and residences that are already complaining of lack of usable data transmission services would not see relief in the near term, and that the Governor's goal of universal broadband within five years would not be met. Issuing data requests or initiating studies of broadband deployment would fall into this same *status quo* category--such information is already included in the Commission's infrastructure reports and available from other sources.[11] Failure to address data transmission and broadband in the current round of universal service rule revisions (1-AC-198) could mean that the issue will be unresolved for another two to three years, at the minimum.

Second, the Commission could modify the current USF rule to increase the data transmission speed of voice grade lines. This would involve raising the data transmission speed to something like 28 kbps or 40 kbps--speeds obtainable by modems. Such an approach has three main drawbacks:

- Such speeds are largely irrelevant today. Customers are embracing services such as Digital Subscriber Loop (DSL) and cable modems that are running orders-of-magnitude faster. Forward-looking countries, such as Japan, are working towards universal deployment of services in the multi-gigabit range. In light of such expectations, a rule mandating speeds of less than 50 kbps is not responsive to consumers or policy goals.
- Modems operating on voice grade lines are an outdated technology. Increasing the data transmission speeds of voice grade lines perpetuates the use of modems.

[10] This would not require the company to provide broadband service to every customer, whether the customer wanted it or not, but only to make the service available. For example, the essential service rules require all providers to offer directory assistance services, but do not require customers to purchase the service.
[11] For instance, the FCC.

Allowing companies to embrace other technologies is preferable, because no single technology is likely to meet all needs.

- The types of investment necessary to make modems perform faster--the creation of digital serving areas, deployment of fiber in the feeder plant and so forth--would be exactly the same as those required for further dispersion of broadband services like DSL. However, while DSL services would allow the providers to obtain additional revenues from DSL service, increased modem speed would not provide additional revenues for the providers.

As a third option, the Commission could mandate data transmission speeds that are relevant to current customer needs. This would require providers to offer some type of data transmission service other than the use of dial-up modems. The Commission could mandate technologies, such as DSL; however, mandating a minimum speed and allowing the providers to select their own technology would be a better approach. The Commission could choose a minimum speed, or adopt the requirements or definitions used by other regulatory entities. Such choices might include 200 kbps in at least one direction,[12] 200 kbps or more in both directions,[13] 500 kbps in both directions,[14] or 1 Mbps in both directions. Other jurisdictions and countries have set targets or goals at much higher rates, including California, which announced a target of universal gigabit broadband service by 2010,[15] and Japan, which is pushing speeds of 40 Mbps to 100 Mbps, and has made that service available to over 80 percent of customers.[16] When considering a minimum speed, the Commission should note that certain technologies have

[12] FCC definition of "high-speed lines" adopted in 2001.
[13] FCC definition of "advanced services," also used as a minimum for current RUS loans since 2003.
[14] RUS definition of "broadband."
[15] *One Gigabit or Bust Initiative: A Broadband Vision for California*, CENIC/ / Gartner, May 2003.
[16] *Down to the Wire*, Thomas Bleha, Foreign Affairs, May/June 2005.

inherent limitations. Dial-up modems cannot exceed speeds of about 50 kbps in either direction. Small satellite dishes cannot manage uploads at more than 100 kbps at most--generally less. Most common technologies being currently deployed would have difficulty providing ubiquitous speeds of excess of 1 Mbps in both directions.

An example of potential language for this third approach to the data transmission issue, together with an analysis, is in Appendix C. A potential difficulty with such a rule would be the assessment of the impact on small businesses. This difficulty is addressed in the Appendix.

As a fourth option, the Commission could mandate deployment of *profitable* broadband services. Such a rule would provide the necessary impetus to the three types of providers (identified above) not investing in broadband, while not significantly burdening providers that have made or are making such investments. Such a rule could also identify areas in which broadband services cannot be profitably offered, and quantify the amount of subsidies or other types of support that would enable the market to serve customers in those areas. Such a rule would also solve some problems relating to the rule's fiscal impact on small businesses.

Potential draft rule language to support such an approach is included in Appendix D.

Docket 1-AC-198

The Commission will soon have before it a Notice of Proposed Rulemaking in docket 1-AC-198. Although the USF Council has not recommended changes to the existing data transmission speed rule, the Commission will need to decide whether to include revisions to Wis. Admin. Code § PSC 160.031 in the draft rules sent out for initial comments from the legislative council and the public at large. If the data transmission rule language is left unchanged in the notice, the comments on this issue are likely to be less focused (although comments are still likely). If the Commission does want more complete comments on this broadband issue, it will

need to consider what form the draft language will take. After comments are received, the Commission can, of course, make final changes to the rules before issuance.

Conclusion

The purpose of this memo is to identify the current situation as it relates to data transmission requirements and circumstance in Wisconsin and to introduce some potential strategies for addressing broadband deployment. The Commission has the opportunity to focus on broadband within the context of the USF rule making that will be launched soon. The range of options is to do nothing and rely on the market to meet (or, in some areas, not meet) needs in the state or to modify the rules in a way that increases speeds of transmission or offers incentives for providers to actually make ubiquitous broadband a priority.

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Attachments

Appendix A
Alternative Data Transmission Technologies

Modems

Modems are a technological work-around that allows the transmission of data over voice grade lines. They function, but modems have a practical upper limit of about 50 kbps. However, modems are cheap, and have come preinstalled on practically every computer sold in the last five years. Customers have them, set-up is simple and they work on any phone line. However, they are an old, slow technology.

Modems operate by converting the digital bit stream sent by a computer into tones which can be sent over the analog telephone lines. At some point in the call, another modem converts the call back into a digital data stream the computer on the other end can use.

Modem speed is a function of both the modem and the telephone line. The series of tones that you can hear at the beginning of a modem call – the process called "handshaking" by the modem industry, consists of the two modems sending signals that first agree on the protocols to be used during the call and then sending data at various rates. The modems will initially try to at their highest speed, but if the data is not transmitted and received accurately and with a minimum of errors, then the modems try reducing speeds until the error rate is sufficiently low.

Integrated Services Digital Network (ISDN)

ISDN is a relatively low-speed service that has been offered by telephone companies for about twenty years. It allows data transmission at up to 128 kbps over copper loops. For a variety of reasons, ISDN has never appealed to many customers. The loop conditioning and other work necessary to equip a line for ISDN is similar to that required for DSL service, and ISDN computer equipment is not common, not cheap and not easily installable by the average user. For all these reasons, ISDN's time, if there ever was one, has passed.

Digital Subscriber Line (DSL)

DSL service has become the standard for high-speed data services offered over copper loops. DSL service comes in several flavors, and a variety of speeds depending on the length of the copper loop (and other factors), but DSL generally offers speeds of 250-500 kbps. Higher speeds are possible. DSL requires conditioned lines, and has significant distance limitations: most telephone companies do not offer DSL service to customers who are served on copper loops longer that about 15,000 feet.[17] Residential DSL service is becoming more widely available. It is present in parts of most cities, as well as many suburbs and some more rural towns. However, distance limitations mean that it is not yet available in more rural areas, and even portions of major urban areas, like greater Madison and greater Milwaukee, have areas which cannot receive DSL.

[17] DSL extender cards are available, and may extend this length somewhat, but they are only beginning to see wide use. This might indicate that the cards have either technical or cost problems. In time, these technical problems are likely to be reduced, and the cost should fall, but this is not a given.

Specific data on the availability of ADSL for Wisconsin customers is not available, but a national study by the Pinkham Group[18] estimates that over 70% of US households are served by central offices equipped to offer DSL service. However, the same report concludes that one third of these households cannot utilize DSL due to distance and technical limitations. Since that report, many Wisconsin providers have extended fiber optics further into the exchange, and made other investments to improve service. DSL is more widely available, but the Commission still receives many complaints from customers who do not have access.

Cable Modems

Cable modems are the primary competitor to DSL services. Cable modems are offered by CATV providers that have upgraded their networks to provide two-way service. Cable modems are roughly comparable to DSL in terms of speed and capacity. Likewise, the investment and effort necessary to upgrade traditional cable plant to support cable modems is comparable to that required to upgrade traditional telephone plant to support DSL. Cable modem service is only available where cable service is available – meaning it is not available in rural areas served only by satellite TV systems.

Two-Way Satellite Services

Two-way satellite data services are available, but have not been widely embraced. Satellite service requires a small dish, comparable to those used for DirectTV™ and other TV systems, and special installation. The cost of the dish, installation and the monthly charges are all quite high, at least compared to other services. More importantly, satellite service is relatively slow, with upload speeds of less than 100kbps. This is too slow to support services like VoIP. Secondly, satellite service has a high "latency" – a high delay in signal and response caused by transmitting the signal to orbit and back. This delay becomes noticeable – and annoying – if the Internet is being used for anything interactive, such as on-line chat, discussions, gaming, VoIP, on-line course work or similar applications. It also causes a slight delay between clicking on an icon and having the icon respond. This combination of problems has kept satellite systems from seeing any significant customer acceptance, despite years of marketing.

T-1 / SDLS / DS-1

These services are traditional high capacity lines provided by telephone companies as a means of serving business customers. T-1s can be provided either divided into voice grade channels, usually used to serve business telephone systems like PBXs, or used to provide data. DS-1s are the digital equivalent to a T-1. SDSL (symmetric DSL) is a less common variety of digital service that is also very similar to a T-1 or DS-1, although the technical details are slightly different.

All of these services are generally available statewide. However, the price of the services – often hundreds to thousands of dollars a month, plus significant construction and installation charges – means that these services are only affordable for business customers. Since the construction charges are often applied per mile, these services are

[18] Broadband Market Study, DSL Current Deployment and Availability Q3, 2001.

less affordable for rural businesses – and cannot solve the data transmission problems for all but a very few, very exceptional rural residents.

Wireless Solutions

Many people have been discussing wireless services as alternatives to telco- or cable- based data services. Wireless services come in four main flavors: cellular/PCS, fixed wireless, Wi-Fi and Wi-Max.

The original cellular mobile service authorized by the FCC was analog. Later, the FCC offered licenses for digital cellular service under the acronym "PCS." Today, cellular service is almost completely digital, with the systems using one of more different methods of encoding data. Digital cellular is capable of transmitting data, but the speeds vary. At present, digital phones can transmit email and small digital photos, and broadband via cellular is only available in limited areas, and for limited applications. Moreover, digital service is not ubiquitous. Cellular shadows – areas without cellular service of any kind – still exist across the state.

Fixed wireless services are very different from cellular services. Fixed wireless services are broadband capable. They have one or more central broadcast antennas, as well as fixed receiving antenna on subscribers' premises. A direct line of sight is necessary between the antenna. These systems have worked quite well in some areas – such as rural Iowa, where the terrain is flat, and almost everyone in a community can get line of site to the top of the grain silo. They are more problematic in areas with extensive forest cover, hills or both. In Wisconsin, such systems are most viable in the southeastern section of the state, however that area is already fairly well served by alternative services. They are least useful in rural northern Wisconsin, which has significant problems with anything requiring direct line of sight to anything other than satellites.

Wi-Fi is a wireless broadband service[19] that allows multiple computers to log into a wireless network and connect to the Internet. Wi-Fi does not require line of sight, but the broadcast range of Wi-Fi service is severely limited. Wi-Fi systems typically have a range of about 300 feet from the transmitter. This is adequate for a business, a home or an urban environment. It is not an ideal solution for rural areas, since a single Wi-Fi transmitter would probably be able to serve a maximum of one or two homes or farms. More importantly, Wi-Fi transmits to end users – but it still requires a separate connection from the antenna to the server or switch. In effect, Wi-Fi could be a replacement for the drop line – it cannot replace the rest of the feeder and distribution network that connects rural homes to the network. Since the drop line is the least expensive part of the distribution network, Wi-Fi is not going to be an answer to universal service problems.

A service which is intended to be more far-reaching is called Wi-Max. In theory, at least, Wi-Max is supposed to be similar to Wi-Fi, but have a broadcast range of up to twenty miles. Wi-Max is not supposed to require line of sight, and should work even in hilly or broken terrain. These statements are all conditional ("supposed to") because Wi-Max is not yet a real service. The standards body that is defining Wi-Max is still in the early stages of the process. That process takes years, and is several years behind

[19] Technically, Wi-Fi is the common usage name for services that comply with IEEE 802.1. Services such as Bluetooth are similar, although built to slightly different standards, and the same analysis applies.

schedule already. The first step, publication of the initial standard, was supposed to occur in 2002. It has not yet occurred.[20]

If Wi-Max does live up to all the promises, if it is actually deployed, and if it is cost effective, it might meet the need for broadband service in rural areas. None of those three "ifs" are guaranteed.

Broadband over Powerline (BPL)

BPL transmits data over existing electrical lines. The signal is transmitted by slightly modifying of the normal current flow. This type of data transmission is nothing new – electric power producers have used a slower version, commonly called "power line carrier," for signaling between substations for years. What is new with BPL is the amount of data being sent. Power line carrier data transmission rates were counted in bits per second. BPL transmission rates are in the 10s of Megabits per second.

Carrying data over BPL requires an interconnection with an internet service provider at one location – presumably near the substation. From that location, the data signal propagates over the electric distribution system. Very high frequency signals degrade rapidly, so a BPL system requires signal regenerators every 1000 to 3000 feet – typically about every 2000 feet. BPL signals cannot pass transformers, so they require some form of work-around to actually reach customers.

The signal regenerators are one potential source of problems for BPL. These must be placed roughly every 2,000 feet. Specifics are not available, but it appears that they require up to 100 watts of power to function. That, plus the frequency range that they operate in, means that they cause very significant amounts of interference. Amateur radio operators have fought BPL because of this interference, and some trials have been shut down as a result. Newer technologies use a process called "dynamic notching" to avoid interference on certain frequencies used by hams. However, that solution might not be feasible. Alan Richenbacher, chief network architect at PPL Telcom, said "If I go with dynamic notching, I might not have any [frequency for] BPL left."[21] The FCC has issued a recent order requiring frequency notching.

A second issue is that BPL signals cannot travel cleanly through transformers. A transformer is an inductor - in telecom terms, it's a giant load coil – and has much the same effect on data transmissions. BPL providers have three different approaches to this problem. The first is to install a Wi-Fi transmitter on the transformer, and use Wi-Fi for the final link to the subscriber. The second is to install bypass wiring within the transformer. The third option is to regenerate the signal at the transformer and attempt to "hammer" it through the inductance.

Wi-Fi has a practical broadcast range of 80-100 feet indoors, and a couple hundred feet outdoors.[22] This is an obvious problem in more rural areas, where a Wi-Fi broadcast station would be required for each subscriber. Wi-Max technology is expected to operate over much greater ranges, but that technology is not due for commercial release for a year or more, and the costs and capabilities are not known. BPL using Wi-Fi and Wi-Max will only be profitable if the cost of the final transmission link is very low, which is not the case with current outdoor Wi-Fi transmitters.

[20] The standards group has a website detailing progress to date, here:
[21] TR Daily, 14 September, 2004
[22] Jeff Duntemann's Wi-Fi Guide, Jeff Duntemann, Paraglyph Press, Scottsdale, AZ, 2004.

Bypass wiring techniques provide a physical connection between the high and low voltage sides of the transformer. This allows the signal to pass, but also raises safety concerns for technicians working on the transformer, and for the possibility of failures allowing high voltage current to reach household wiring.

Some providers simply blast the signal through the transformer, but no information on the costs or effectiveness of this method is available. Since this techniques has been tried, and has not been successful, several times in the past, it seems unlikely that it will be cost effective in the future.

BPL technologies typically have a backbone transmission rate of approximately 30 Mbps. (That is not very fast – business networks, including the PSCW network, typically have a data transmission rate of 1 gigabit per second or faster.) The BPL capacity is shared among the customers using BPL over that particular transmission facility. That typically provides customers with end user speeds of 256 kbps to 1 Mbps, which is competitive with current DSL and cable modem offerings. However, fiber to the home roll-outs are promising speeds of 1gigabit per second to each and every home, and services which require transmission speeds in that range (e.g. the cable TV equivalent to VoIP) are being planned. BPL technologies are not currently capable of providing service at those speeds. Attempting to significantly increase speeds would require additional power in the signal regenerators, and increase the interference / signal notching problems.

BPL technology is still evolving. At present, it may be a reasonable alternative for suburban areas, but it does not seem cost effective for more rural areas. It appears that significant technological breakthroughs will be needed if BPL is to serve truly rural areas, but it is possible that such breakthroughs could be made.

Appendix B
Survey of Rural Chambers of Commerce

Overview

In order to estimate the extent of data transmission speed problems rural customers are currently encountering, staff developed a survey. Staff surveyed 35 rural Chambers of Commerce chosen at random. The survey consisted of 5 multiple choice questions. Staff also noted any significant comments made by the respondents.

Survey Methodology

The Chambers of Commerce were selected off the Wisconsin Online county information website (http://www.wisconline.com/counties/index.html) For each county, the Chamber of Commerce appearing third in the list was chosen. If that Chamber was not available to answer the survey, the closest Chamber on the list was then called. Staff began with rural counties and began calling counties until 35 responses had been received[23]. The survey was performed in fall of 2004.

The survey included five questions. All were multiple choice. The staff experimented with asking for specific numbers, instead of general results like "many," but then the responses were almost always "don't know."

Questions and Results

1) What is your best estimate of the percentage of businesses in your area ordering products or supplies online, or otherwise using the Internet for business purposes?

(Most do / Some do / A few do / don't know?)

Answer	Number	Percent	Cumulative %
Most	13	42%	42%
Some	16	52%	94%
Few	2	6%	100%
None	0	0%	100%
Don't Know	4		

The responses to this question was fairly predictable. Four respondents answered "I don't know." From the rest, it is clear that rural businesses make use of the Internet.

2) Have any member businesses mentioned problems obtaining the Internet access or high-speed data connections they require, and that would include slow speeds?

(Many have / Some have / A few have / None have / don't know?)

[23] The Chambers of Commerce included in this survey were: Adams Area COC, Black River Falls, Cable, Colby, Darlington, Eagle River, Fennimore, Grantsburg, Iola / Scandinavia, Markesan, Menomonee, Mercer, Mineral Point, Minoqua, Neillsville, New Richmond, Oconto Falls, Osceola, Phelps, Phillips, Pickerel / Pearson, Prairie du Chien, Prescott, Reedsburg, Richland Area, Shawano, Spencer, Spencer, Spooner, Superior, Tomah , Tomahawk, Trempealeau, Winter, and Wisconsin Rapids.

Answer	Number	Percent	Cumulative %
Many	5	17%	17%
Some	6	21%	38%
Few	3	10%	48%
None	15	52%	100%
Don't Know	6		

Even a survey concentrating on businesses, and asking only if the respondent remembered businessmen complaining about data transmission, found almost half the communities reporting problem with Internet access. Most telling were a few respondents who volunteered statements like "those businesses in town are okay, but once you get out of town, there is nothing but dial-up."

3) Do you know if DSL or cable modem service is available in your community?
(DSL / Cable Modem / both / none / don't know.)

The questions on DSL and/or Cable Modem showed that one or both services are available in the vast majority (93%) of large rural towns, but, again, respondents volunteered statements like "it is only available in the eight blocks in the center of town – outside that it just doesn't work."

4) How would you characterize the number of businesses using satellite dishes for data transmission:
(Most do / Some do / A few do / don't know?)

The question on satellite dishes did not produce usable data. The vast majority (69%) answered "do not know," and some of the other responses may be questionable. The respondents may have been confusing satellite TV and data satellite dishes.

5) Are you aware of residential customers who have mentioned problems obtaining the Internet access or high-speed data connections they require?
(Many have / Some have / A few have / None have / don't know?)

Answer	Number	Percent	Cumulative %
Many	7	23%	23%
Some	6	19%	42%
Few	3	10%	52%
None	15	48%	100%
Don't know	4		

Slightly over half of the business representatives reported at least a few local residents that could not get adequate data transmission speeds. Almost one in four communities reported that the problem was widespread. In some cases, the people reporting widespread problems also stated that high-speed services like DSL and cable modems were not available, but some reported that they were available, but only "in town." In more rural areas surrounding the towns, these services were not deployed or obtainable.

Appendix C:
Proposed Rule Language and Analysis for Increased Data Transmission Speed

Overview

Staff has drafted several versions of sample language for the section of the administrative code relating to data transmission speed in the USF rules and in the advanced services rules. The versions vary primarily in terms of the speeds and timing that are required, and in the impact on the advanced services rules. All of these drafts contain five components that the Commission staff believes are essential to workable and reasonable rules: 1) technological neutrality, 2) phase-in periods, 3) provider options/flexibility, 4) real world speed requirements and 5) reasonable impacts on providers.

Concept of this draft:

This draft language is intended to mandate deployment of higher speed data transmission services within a reasonable time period. The language raises the minimum speeds to reflect current customer demands.

Rule Revisions Language

The following language updates the current rules. The original language is in plain text. Existing language that would be deleted is ~~struck through~~. Proposed insertions are in *Italics*.

PSC 160.02(1k)
(1k) *Data Transmission service is a digital service meeting the requirements of PSC 160.031.*

PSC 160.03(2)(a)2.
2. ~~Line quality capable of data~~ *Data* transmission as specified in s. PSC 160.031.

PSC 160.031 Essential data transmission capability.
~~**(1)** The data transmission capability specified in s. PSC 160.03 shall be at least 9600 bits per second effective July 1, 1996~~
~~**(2)** For lines extending greater than 10,000 feet from the central office, this data transmission capability requirement shall be met under an implementation schedule to be set by the commission.~~

(1) *Local exchange service providers must offer data transmission service to 50 percent of customers served by the local exchange service provider no later than one year after the effective date of this rule…[revisor inserts date], and 70 percent by 3 years after the effective date of this rule…[revisor inserts date].*

(a) The local exchange service provider may meet this requirement by offering a data service
(1) that operates within the voice grade frequencies, or,
(2) that operates over the same plant but at different frequencies, or
(3) that is separate and distinct from the voice grade offering, or
(4) by reselling or offering a service provided by a different provider

(2) *The data transmission service offering must meet the following criteria:*

(a) The service must provide data transmission rates of at least 200 kpbs upstream and 300 kbps downstream.
(b) The service complies with all relevant national standards.
(c) At least one local Internet Service Provider supports access via the service.
(d) Customers are reasonably able to obtain, install and operate customer premises equipment compatible with the service.
(e) The price for the service is not excessive. A monthly charge of $50.00 or less, and installation / service initiation fees of less than $250.00 will not be considered excessive. The Commission may approve higher fees and charges.

Technological Neutrality

Both statutes and practicality mandate that the universal service rules do not try to mandate any given technology. That is why the essential services definition is phrased in terms of functions, not technology. These draft rules are phrased in terms of bits – the primary unit of any digital service, as opposed to bandwidth, channels or other technology-specific unit. The actual speeds were chosen more as examples – the Commission should choose appropriate values. The rules also allow providers to offer in band transmission over the public switched telecommunications network (PSTN) (e.g., modems), out of band transmission over the PSTN (e.g. DSL), or any other technology capable of data transmission. Providers may meet this requirement by partnering with, or reselling the services of, any other providers offering a suitable data transmission service.

Phase-In Periods

The staff proposal calls for half of all customers to be served within one year of the effective data, and 70 percent to be served within 3 years. In many areas, the providers have already met the proposed requirements[24]. In other areas, providers may have to upgrade plant and make other investments. The Commission needs to allow a reasonable amount of time for companies to complete these tasks. The one and three year deadlines, and the provisions for extensions, should allow all companies to meet these rules without undue effort.

Real-World Speed Requirements

In past documents (e.g. staff's 2002 Modem Speed Whitepaper), staff has described customer uses of the Internet. That information is still relevant – but it can be summed up as follows: The Internet has been described as the "Information Superhighway," and many people, including Governor Doyle, have stressed the importance of that superhighway to economic development. Many parts of rural Wisconsin still show the effects of being on the concrete superhighways – or of not being on them. Internet access is a similar issue: if rural areas cannot get "on," they risk economic collapse. The numbers chosen are examples – the Commission should carefully consider raising or lowering the values based on it's experience. In any case, the Commission should expect to modify any values again in light of public comments.

[24] The WSTA estimates that 64 percent of all residential customer now have access to ADSL service. Information from alternative regulatory plans shows that most companies with alternative regulation plans have made DSL service available to somewhere between 60 and 95 percent of customers – with the specific number varying between companies.

Provider Options

Circuit-switched telephone service will be, in the near future, completely replaced by packet-switched services. The outside plant built for the circuit switched world will need to be upgraded or replaced. How this change is managed is something each provider can best decide for itself – it should not be decided by the USF rules. Therefore, the rules allow the providers to decide whether to upgrade their copper facilities to support DSL services, to deploy other advanced services such as fiber to the home, or to offer other advanced alternatives. Providers should also be able to meet the data transmission requirement by offering customers services provided by other vendors, such as satellite systems, cable modems or whatever new technology might be available – subject only to the caveats that the services be affordable and usable by customers. The draft rules provide for those options.

Cost of Implementation

The 50 and 70 percent levels were chosen because these levels have already been attained by most of the companies that have been making widespread investments in these technologies. The cost of compliance for these companies will consist mainly of submitting a copy to the commission of federal reports which already require detailed information on deployment of such services.

For those companies that have not made investments in these services, or have made investments only in narrow, targeted geographic areas, the costs will be more significant. These companies may need to upgrade their infrastructure. In some cases, where the infrastructure is deficient, these costs may be large. Quantifying those costs will be difficult.

It will also be difficult to quantify the offsetting costs of not changing these requirements. The Chamber of Commerce study shows that businesses are having difficulty finding the data transmission services and speeds they require. The lack of these services cost businesses money, in terms of reduced efficiency, lost opportunities and lost sales. Residential customers also pay a cost, in terms of lost efficiencies in shopping, research, job searches and other on-line activities. These costs are also real, but are difficult to quantify.

Appendix D:
Proposed Rule Language and Analysis for Increased Data Transmission Speed with Exemption for Unprofitable Areas.

Overview

Staff has drafted several versions of the sample language for this section of the administrative code, and of the advanced services rules. The versions vary primarily in terms of the speeds and timing that are required, and in the impact on the advanced services rules. All of the staff drafts contain five components that staff feels are essential: 1) technological neutrality, 2) phase-ins, 3) provider options/flexibility, 4) real world speed requirements and 5) reasonable impacts on providers.

Concept of this draft:

This draft language is intended to mandate deployment of profitable data transmission services. The draft would require providers to make aggressive deployment of high-speed data transmission services in all areas where those services are profitable. If a provider cannot make a business case for deployment of a service, then the provider could file that information (on a confidential basis), and would not be required to deploy unprofitable services. The Commission would then have accurate, quantifiable information on areas which the market cannot serve, and could both assist companies in obtaining RUS support for these investments and/or consider additional USF subsidies or support based on that information.

Rule Revisions Language

The following language updates the current rules. The original language is in plain text. Existing language that would be deleted is ~~struck through~~. Proposed insertions is in *Italics*.

PSC 160.02(1k)
(1k) *"Data transmission service" means a digital service which meets the requirements of PSC 160.031(2).*

PSC 160.03(2)(a)2.
2. ~~Line quality capable of data~~ *Data* transmission service as specified in s. PSC 160.031.

PSC 160.031 Essential data transmission capability.
~~**(1)** The data transmission capability specified in s. PSC 160.03 shall be at least 9600 bits per second effective July 1, 1996~~
~~**(2)** For lines extending greater than 10,000 feet from the central office, this data transmission capability requirement shall be met under an implementation schedule to be set by the commission.~~

(1) *Local exchange service providers shall offer a data transmission service to 50% of customers served by the local exchange service provider no later than 1 year after the effective date of this rule…[revisor inserts date], and 70% by 3 years after the effective date of this rule…[revisor inserts date].*

(a) The local exchange service provider may meet this requirement in any of the following ways, or via a mix of these:

(1) By offering a data transmission service that operates within the voice grade frequencies.

(2) By offering a data transmission service that operates over the same plant as voice grade offerings, but at different frequencies.

(3) By offering a data transmission service that is separate and distinct from the voice grade offering.

(4) By reselling or offering a service furnished by a different provider.

***(2)** The data transmission service offering shall meet all of the following criteria:*

(a) The service provides data transmission rates of at least 200kpbs upstream and 300kbps downstream.

(b)The service complies with all relevant national standards.

(c) At least one local Internet Service Provider supports access via the service.

(d) Customers are reasonably able to obtain, install and operate customer premises equipment compatible with the service.

(e) The price for the service is not excessive. A monthly charge of $50.00 or less, and installation / service initiation fees of less than $250.00 will not be considered excessive. The Commission may determine that higher fees and charges are not excessive based on the facts and circumstances of a particular offering.

***(3)** A local exchange service provider may petition the Commission for a variance from the requirement in sub. (1) if the expected revenue from data transmission services is not sufficient to cover the cost of the investments necessary to offer the service. The petition shall include all of the following:*

(a) A statement from the provider detailing the areas in which the provider contends the provision of data transmission service is not financially viable

(b) Details of the portions of the provider's service area (if any) within which the provider will offer data transmission service.

(c) Detailed data on the investment necessary to provide data transmission service to the areas in which the company contends the provision of such service is not financially viable, as well as information on the investment necessary to provide data transmission service in the rest of the provider's service territory.

(d) Forecasts of the expected revenues for the data transmission service, per customer.

(e) A statement of whether the provider has sought Rural Utility Service funding for the investment necessary to provide data transmission service, and the results of that process.

***(4)** A provider that files a completed petition under sub. (3) will be granted a one year extension for meeting the requirements in sub. (1). In addition, the Commission may, after investigation and opportunity for comment, do one or more of the following:*

(a) Grant an additional extension.

(b) Assist the company in obtaining Rural Utility Service funding for data transmission service deployment.

(c) Direct that state Universal Service Fund support be made available to the provider to enable it to deploy data transmission service.

PSC 160.05(1)(s)

***(s)** Data transmission service deployment, as specified in s. PSC 160.031(4).*

{reletter 160.05(s) – anything else – to 160.05(t)}

Technological Neutrality

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Phase-In Periods

The staff proposal calls for half of all customers to be served within one year of the effective data, and 70 percent to be served within 3 years. In many areas, the providers have already met the proposed requirements[25]. In other areas, providers may have to upgrade plant and make other investments. The Commission needs to allow a reasonable amount of time for companies to complete these tasks. The one and three year deadlines, and the provisions for extensions, should allow all companies to meet these rules without undue effort.

Real-World Speed Requirements

In past documents (e.g. staff's 2002 Modem Speed Whitepaper), staff has described customer uses of the Internet. That information is still relevant – but it can be summed up as follows: The Internet has been described as the "Information Superhighway," and many people, including Governor Doyle, have stressed the importance of that superhighway to economic development. Many parts of rural Wisconsin still show the effects of being on the concrete superhighways – or of not being on them. Internet access is a similar issue: if rural areas cannot get "on," they risk economic collapse.

Provider Options

Circuit-switched telephone service will be, in the near future, completely replaced by packet-switched services. The outside plant built for the circuit switched world will need to be upgraded or replaced. How this change is managed is something each provider can best decide for itself – it should not be decided by the USF rules. Therefore, the rules allow the providers to decide whether to upgrade their copper facilities to support DSL services, to deploy other advanced services such as fiber to the home, or to offer other advanced alternatives. Providers should also be able to meet the data transmission requirement by offering customers services provided by other vendors, such

[25] The WSTA estimates that 64 percent of all residential customer now have access to ADSL service. Information from alternative regulatory plans shows that most companies in alt-reg plans have made DSL service available to somewhere between 60 and 95 percent of customers – with the specific number varying between companies.

as satellite systems, cable modems or whatever new technology might be available – subject only to the caveats that the services be affordable, be usable by customers and provide the necessary data transmission speed. The draft rules provide for those options.

Cost of Implementation

In general, these rules are drafted to allow all companies to meet the requirements without incurring significant additional costs, and where the expected cost of additional facilities will be less than the expected return from the advanced services provided over those facilities. However, some companies may be located in areas where the costs of necessary facilities upgrades are too high to allow profitable deployment. The draft rules, therefore, offer those companies the alternative of rolling out the services in areas which are cost effective, and filing a cost study and provisional roll-out plan for other areas. The filing would show the cost of providing services in those areas, and would include roll-out options that might be contingent on Universal Service support funding. The Commission would rule on the plans, and determine whether - and how much - universal service money could be made available.

Staff has carefully considered this proposal in light of the new statutory requirements for rulemaking. The most difficult number to quantify will be the fiscal impacts, especially the impact on customers, of inactivity. The negative fiscal impacts on customers and rural communities of inadequate data transmission will continue if the rules are not changed. For the businesses that have trouble obtaining the data speeds they need, the costs will be a mix of lost sales and wasted employee time – both difficult to quantify. For residential customers, the costs are also those of lost opportunities and lack of options. The assumptions required to calculate those costs may be debatable, but not the fact that both business and residential customers face real economic costs when the services they demand are not available.

The impact on providers will be minimal. A few providers may be required to make investments, but the inclusion of the cost-recovery caveat means that providers should only be making investments which will return a reasonable profit. The main costs to providers will be the cost of compliance filings, and these will be minimal. These companies already report on service availability for the PSCW Infrastructure report, and in annual reports. Moreover, the FCC has stated that it will require all rural telephone companies to file the complete the FCC Form 477 report, which would include all the detail necessary for the staff to verify compliance. The cost of compliance, for these companies, would likely be the cost of forwarding a copy of existing forms to the staff for review – and since these forms are already electronic, that cost should be insignificant.

Affordability Criteria

The draft rules include a provision requiring that the price of the service not be excessive. That provision may be controversial. The intent was to ensure that companies not claim that their high-cost, business-oriented services, like high cost fiber optic lines, be considered as fulfillment of this requirement. Including an affordability standard ensure that the data transmission offering is actually usable to all customers. Absent an affordability requirement, a company could conceivably claim that it met the requirement

by offering DS-3 service to all customers – at prices of several thousand dollars per month. Such a service might indeed be offered to all customers – and possibly even provided to the few who could afford it – but such an offering would clearly not meet Governor Doyle's goal of "universal, affordable" broadband.